REMARKS

With close attention to the Office action of January 11, 2005, claims of this application have been amended..

Disposition of Claims

Claims 1-9, 12-15 and 21 were pending in the application at the time of the Office action.

Claims 1-7, 12-15 and 21 and new claim 62 are now pending in the application at the time of the Office action. Claims cancelled and/or previously cancelled, without prejudice, are 8-11, 16-20 and 22-61.

Claims 1-4 and 12-15 were allowed by the Office action.

Rejections

I. In Response to Rejection under 35 U.S.C. 102(b):

Examiner has rejected claims 5- 9 and 21 as being anticipated by Alexander et al. However, inventions disclosed in claims 5- 9 and 21 are different from Alexander et al. in their configurations and functions.

A. Concerning Claim 5

Examiner notes that the invalid charge discharging unit in the present invention is disclosed in Alexander et al. However, the configurations of the invalid charge discharging unit in the present invention and a corresponding part in Alexander et al. are different from each other.

The invalid charge discharging unit in claim 5, as written out in the claim, drives the charge transfer unit to discharge an invalid charge while the charge accumulating units accumulate the signal charges. In contrast, in col. 5, lines 62- 63 that Examiner pointed out, Alexander et al. discharges signal charges of the well 34 (node 20) to the bucket overload gate (gate 28 and diffusion 22). There is only disclosed discharging signal charges instead of invalid charges, and the bucket overload gate is not a charge transfer unit. This discharging operation in Alexander et al. does not discharge the invalid charges generated at the transfer unit (output diffusion 24).

B. Concerning Claim 6

Examiner states in the action that Alexander et al. discloses in col. 5, line 65- col. 6, line 3 the dark current suppressing unit in claim 6 of the present invention. However, configuration disclosed in col. 5, line 65- col. 6, line 3 of Alexander et al. can not suppress the dark current flowing in from the first-plane side, as in the present invention.

The dark current suppressing unit in the present claim 6 approximates a potential of the first-plane side of the charge transfer unit to a substrate potential to suppress dark current flowing in from the first-plane side to the charge transfer unit, as is written out in the claim. In contrast, the potential control by the transfer gate 30, which is the part in Alexander et al. corresponding to the dark current suppressing unit, cannot suppress this dark current like the present invention. Alexander et al. does apply Zero bias to the transfer gate 30 to create a wall of potentials so that the possibility of charge overflow from node 20 to output diffusion 24 can be eliminated. Also, Alexander et al. does have what corresponds to the dark current from the first-plane side of the present invention, which is the dark current which generates between the epitaxial layer 18 and the layer 29. But the potential control by the transfer gate 30 is only a partial potential control and cannot suppress, as is clear from Fig. 4a of Alexander et al.

C. Concerning Claim 7

Examiner states in the action that Alexander et al. discloses in col. 5, line 65- col. 6, line 3 the excessive charge discharging unit in claim 7 of the present invention. However, the configurations of the invalid charge discharging unit in the present invention and a configuration disclosed in col. 5, line 65- col. 6, line 3 in Alexander et al. are different from each other.

The excessive charge discharging unit in the present claim 7 drives the charge transfer unit to discharge the excessive charge occurring due to exceeding of a saturation charge amount of the charge accumulating units, as is written out in the claim. Examiner states that the function of discharging the excessive charge overflowed from the well 34 (node 20) to the bucket overload gate (gate 28 and diffusion 22) in Alexander et al.

corresponds to the function of the excessive charge discharging unit in the present claim 7. However, the bucket overload gate is not the same as the charge transfer unit of the present invention. Moreover, what does correspond to the charge transfer unit in Alexander et al., which is the output diffusion 24, is not driven to discharge excessive charge by the function disclosed in Alexander et al in col. 5, line 65- col. 6, line 3.

D. Concerning Claims 8 and 9

Claims 8 and 9 were rejected, but they are now canceled from the list of claims in the present invention.

E. Concerning Claim 21

Claim 21 is so amended that it is dependent on claim 5. Therefore, when claim 5 is free of reasons to reject, claim 21 should also be.

II. Concerning the Newly Added Claim:

Claim 62 is constructed so that it is dependent on claim 5. Therefore when claim 5 is free of reasons to reject, claim 62 should also be.

Summary

Accordingly, Claims 1-7, 12-15 and 21 and new claim 62 are now believed to be neither anticipated nor rendered obvious by the art of record. It is believed that the foregoing resolves all remaining issues, and the application is in good order for allowance, and a Notice of Allowance is solicited. If Examiner believes there is any remaining issue, which could be readily resolved or other action could be taken to advance this application, such as Examiner's amendment or interview by telephone or in person, it is requested that Examiner please telephone the undersigned, who will cooperate to advance prosecution.

PATENT

If necessary to effect a timely response, this paper should be considered as a petition for extension of time of length sufficient to be considered timely. Any fees required are authorized to be charged to Deposit Account No. 07-1985.

Respectfully submitted,

11 April 2005
Date

Peter S. Gilster, Reg. No. 25,337
Attorney for Applicants
Greensfelder, Hemker & Gale, PC
10 S. Broadway, Suite 2000
St. Louis, Missouri 63102
314-345-4741 Telephone Office Direct
314-241-9090 Telephone Office General
314-345-4704 Facsimile
Customer No. 22807

PSG:kmb